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(71) Applicant(s)

Kabushiki Kaisha Toshiba

(Incorporated in Japan)

72 Horikawa-cho, Saiwai-ku, Kawasaki-shi,
Kanagawa-ken, Japan

Toshiba Ave Co. Ltd

(Incorporated in Japan)

3-9 Shimbashi 3-chome, Minato-ku, Tokyo, Japan

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(72) Inventor(s)

Yoshiyuki Makino

Masahiro Imai

(74) Agent and/or Address for Service

Marks & Clerk

57-60 Lincoln's Inn Fields, LONDON, WC2A 3LS,

United Kingdom

(54) Washing machine with means for storing and displaying data of contents of washing operation

(57) A full automatic washing machine includes a non-volatile memory (12), such as EEPROM, for storing data of contents of the washing operation executed at a plurality of times in the past. A control circuit (1) originates the data during execution of every washing operation. The data stored in the non-volatile memory (12) are read out and displayed when some switches (17, 18, 19) on an operation panel (13) are operated in a specific mode. The displayed data serve to find out the cause for trouble or failure in the washing machine. The non-volatile memory retains the written data when the power is switched off.

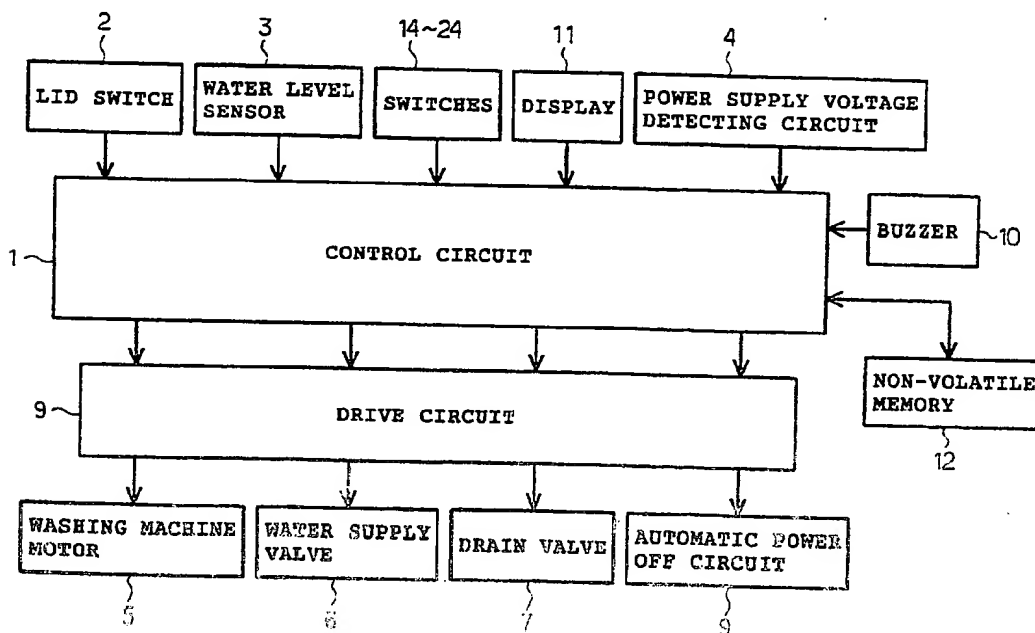


FIG.1

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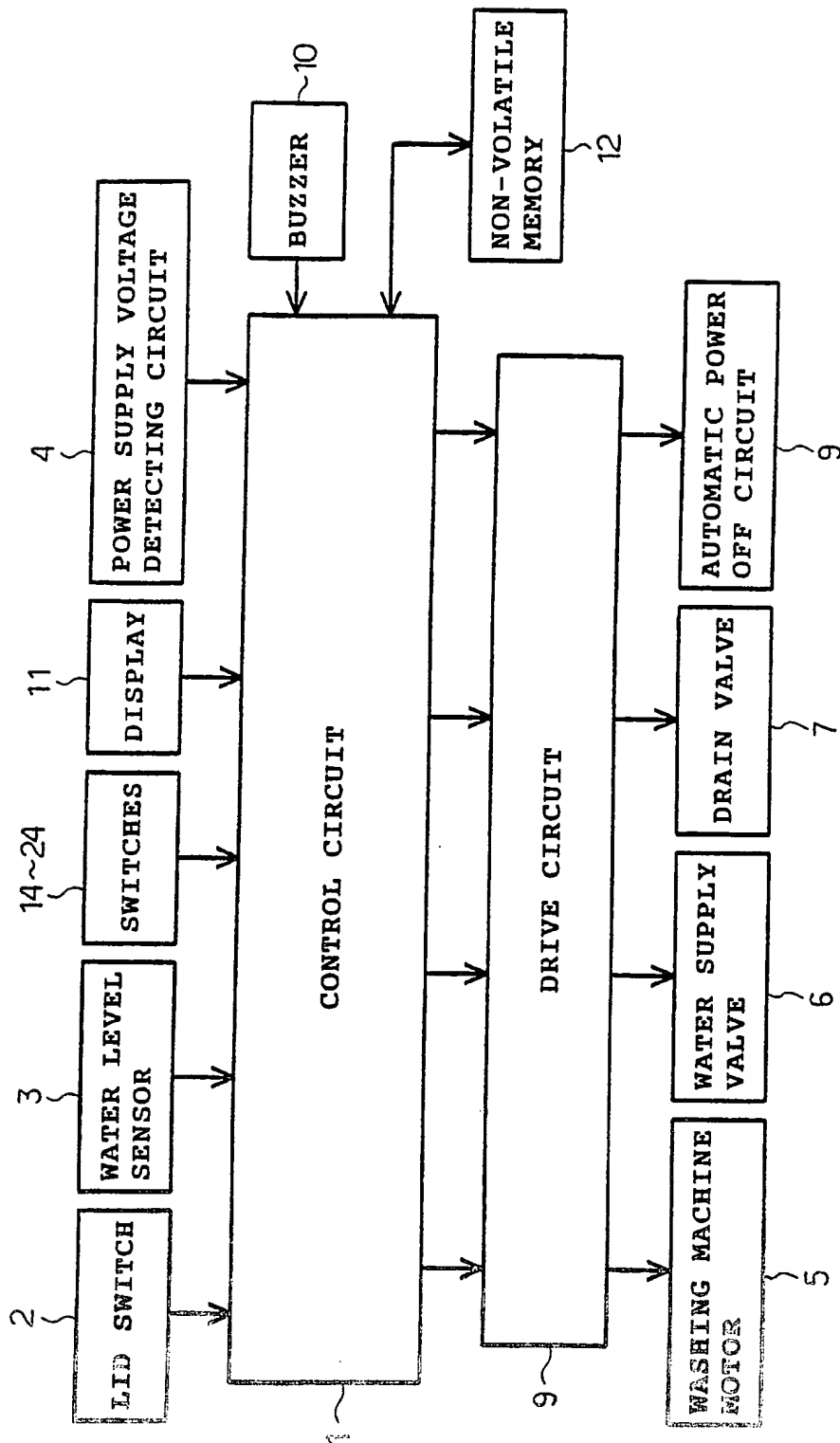


FIG.1

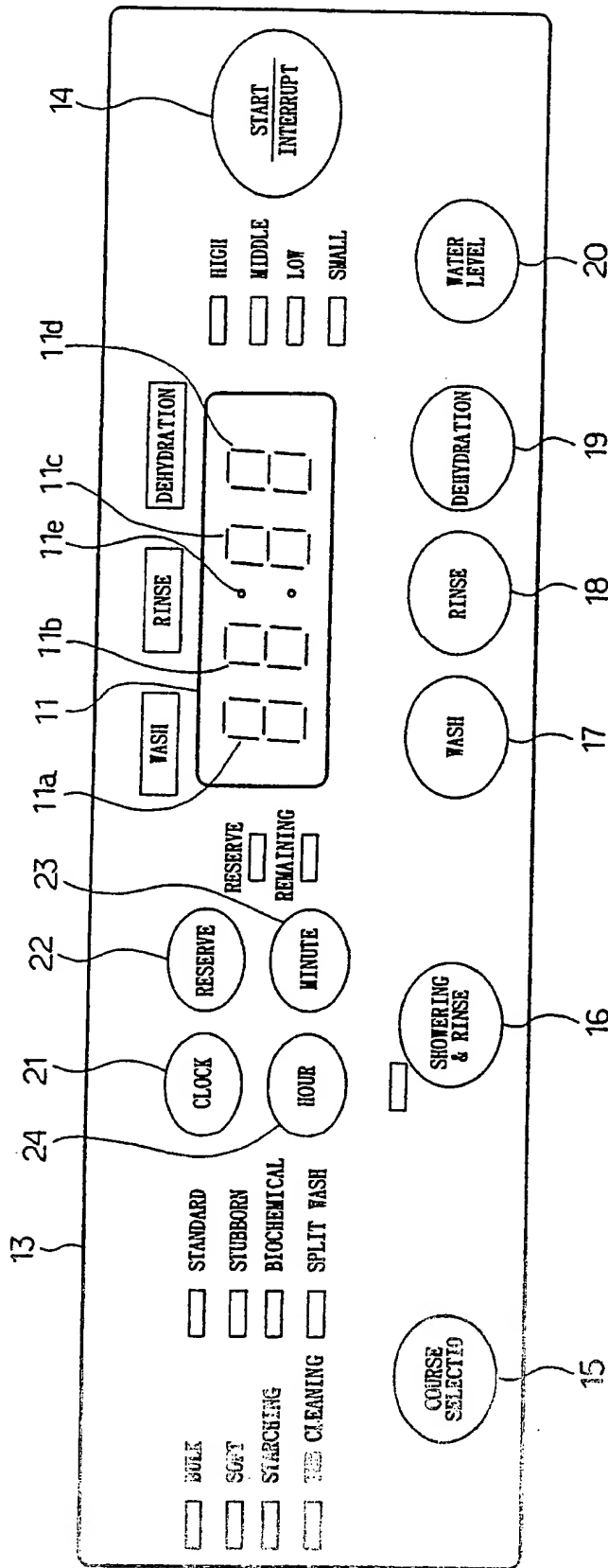


FIG. 2

OPERATION COURSE	BEFORE START	WATER SUPPLY 1	SOAKING	WASH	DRAINAGE 1	DEHYDRATION 1	WATER SUPPLY 2	RINSE 1	DRAINAGE 2	DEHYDRATION 2	WATER SUPPLY 3	RINSE 2	DEHYDRATION 3	FINAL DEHYDRATION	COMPLETION OF COURSE
STANDARD				12"		2"		2"		2"		3"		6"	
STUBBORN				11"		2"		2"		2"		3"		6"	
BULK				12"		2"		2"		2"		3"		3"	
SOFT				3"		1"		1"		1"		1"		1"	
MANUAL				15"											
DATA CODE OF INTERUPTED STEP	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14

FIG.3

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UPPER LOWER	0	1	2	3		7
0	LATEST MEMORY ADDRESS		No. 11			
1	OPERATIVE INFORMATION	No. 6				
2	No. 1			No. 17		
3			No. 12			
4		No. 7				
5	No. 2			No. 18		
6			No. 13			
7		No. 8				
8	No. 3			No. 19		
9			No. 14			
A		No. 9				
B	No. 4			No. 20		
C			No. 15			
D		No. 10				
E	No. 5			No. 21		
F			No. 16			

FIG. 4

ITEM DATA CODE	4 bits				4 bits				2 bits		4 bits		ERROR CONTENTS
	OPERATION COURSE	INTERRUPTED STEP	POWER SUPPLY VOLTAGE LEVEL (V)	OPERATING WATER LEVEL	AUTOMATIC WATER LEVEL SETTING	WASH PERIOD (MIN.)							
0	MANUAL	BEFORE START	~89.5 OR BELOW	HIGH	HIGH	1 6	NONE						
1	STANDARD	WATER SUPPLY 1	89.5 ~91	MIDDLE	MIDDLE	7	ABNORMAL DRAINAGE						
2	STUBBORN	SOAKING	91 ~92.5	LOW	LOW	2	OPEND STATE OF ACCESS LID DURING DEHYDRATION						
3	BULK	WASH	92.5 ~94	SMALL	SMALL	3	TUB UNBALANCE						
4	SOFT	DRAINAGE 1	94 ~95.5			4	—						
5	—	DEHYDRATION 1	95.5 ~97			5	ABNORMAL WATER SUPPLY						
6	—	WATER SUPPLY 2	97 ~98.5			6	ABNORMAL CONDITION OF WATER LEVEL SENSOR						
7	—	RINSE 1	98.5 ~100			7	ABNORMAL CONDITION OF MOTOR						
8	—	DRAINAGE 2	100 ~101.5			8	ABNORMAL CONDITION OF ROTATIONAL SENSOR						
9	—	DEHYDRATION 2	101.5 ~103			9	—						
10	—	WATER SUPPLY 3	103 ~104.5			10	—						
11	—	RINSE 2	104.5 ~106			11	—						
12	—	DRAINAGE 3	106 ~107.5			12	—						
13	—	FINAL DEHYDRATION	107.5 ~109			13	—						
14	—	COMPLETION OF COURSE	109 ~110.5			14	—						
15	—	—	110.5~			15	—						

FIG. 5

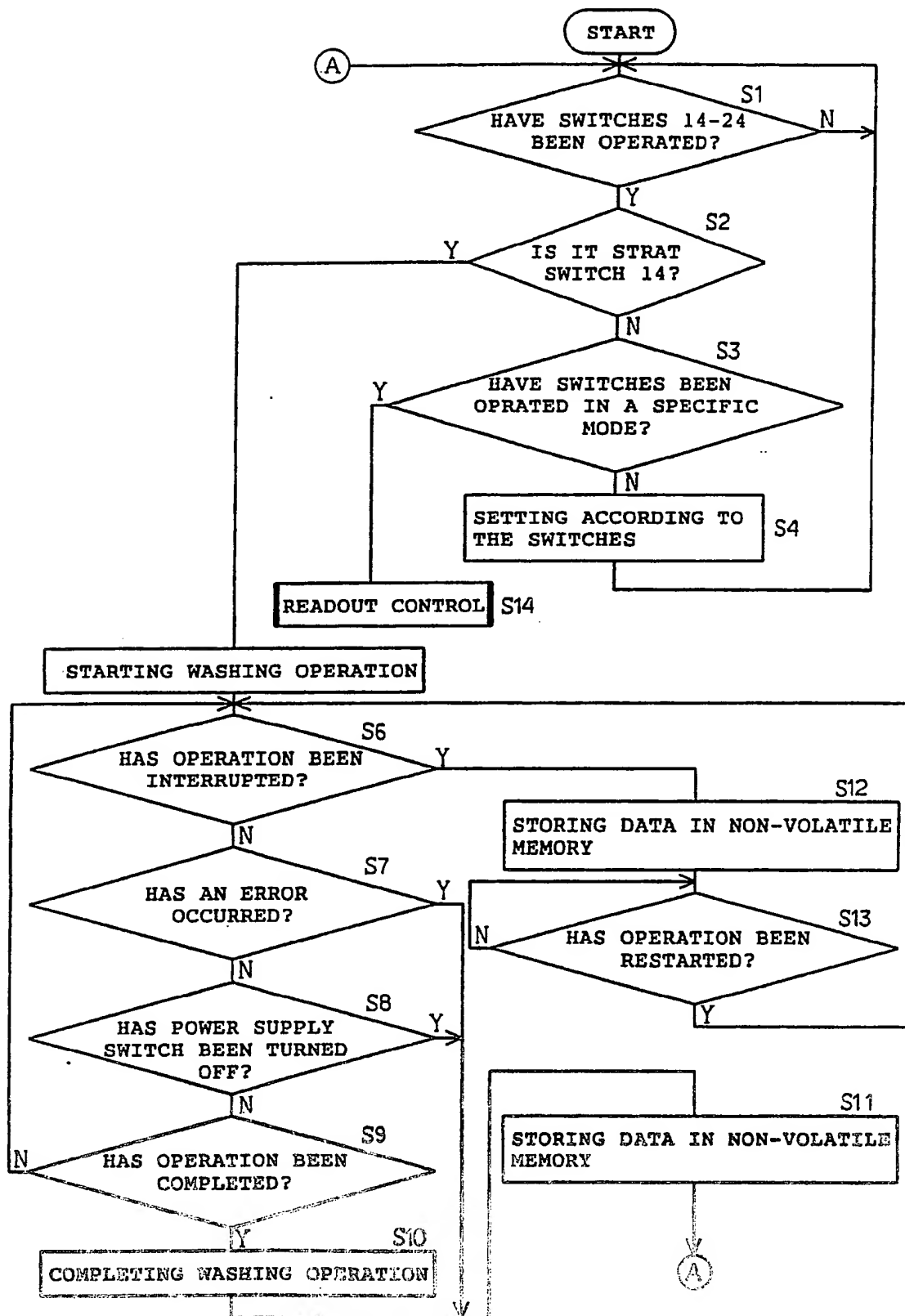


FIG. 6

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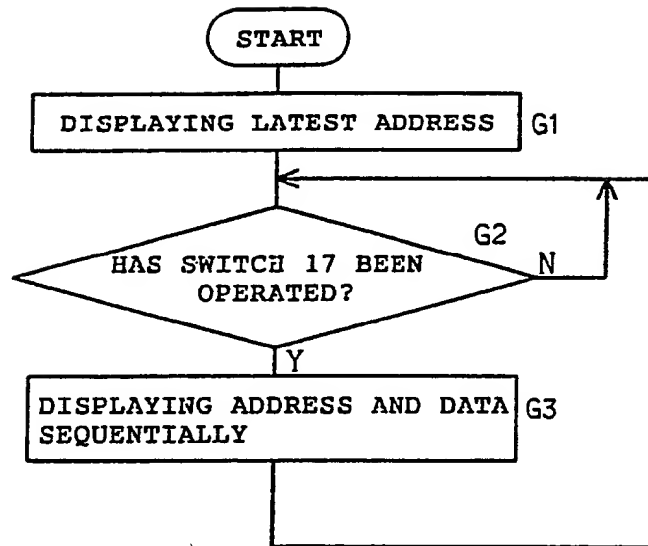


FIG. 7

FIG. 8A

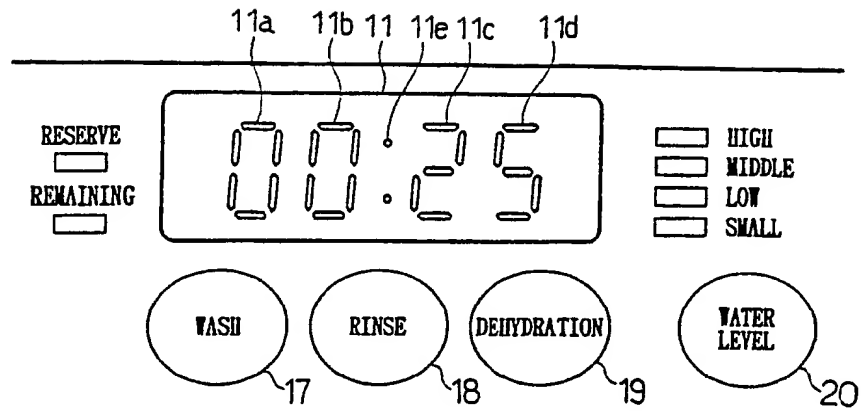


FIG. 8B

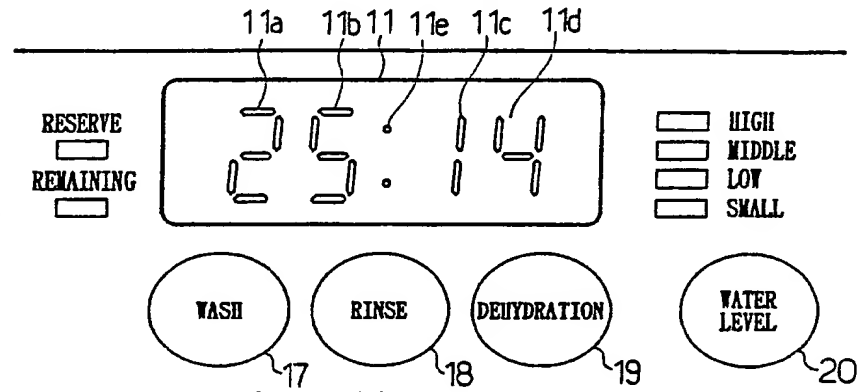


FIG. 8C

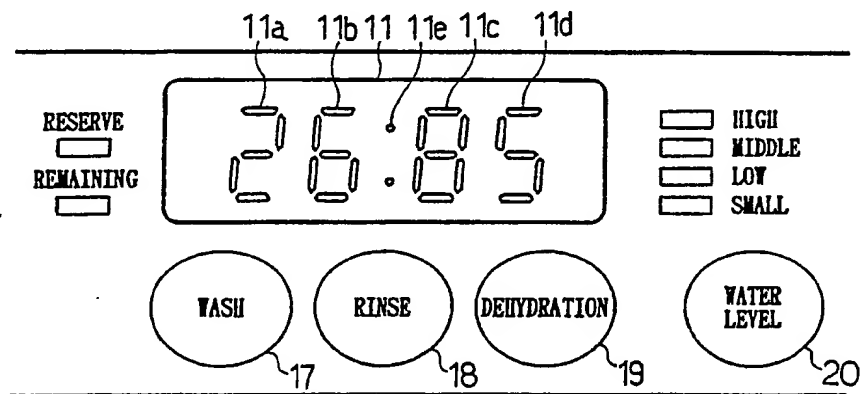
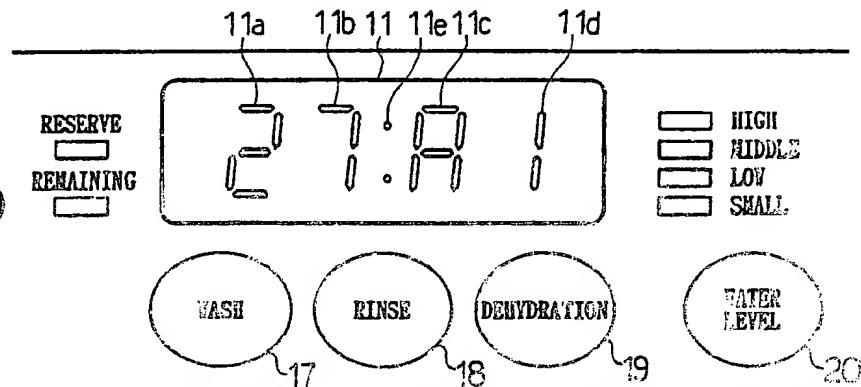


FIG. 8D



ADDRESS	2	5	2	6	2	7
DATA	1	4	8	5	A	1
DATA (BIN)	0001	0100	1000	01	1010	0001
ITEM	COURSE	INTERRUPTED STEP	POWER SUPPLY VOLTAGE	OPERATING WATER LEVEL	AUTOMATIC WATER LEVEL SETTING	WASH PERIOD ERROR CONTENTS
DATA CODE	1	4	8	1	1	10 1
SIGNIFICATION	NORMAL COURSE	DRAINAGE 1	100 101.5	MIDDLE	MIDDLE	10 MINUTES ABNORMAL DRAINAGE

FIG. 9

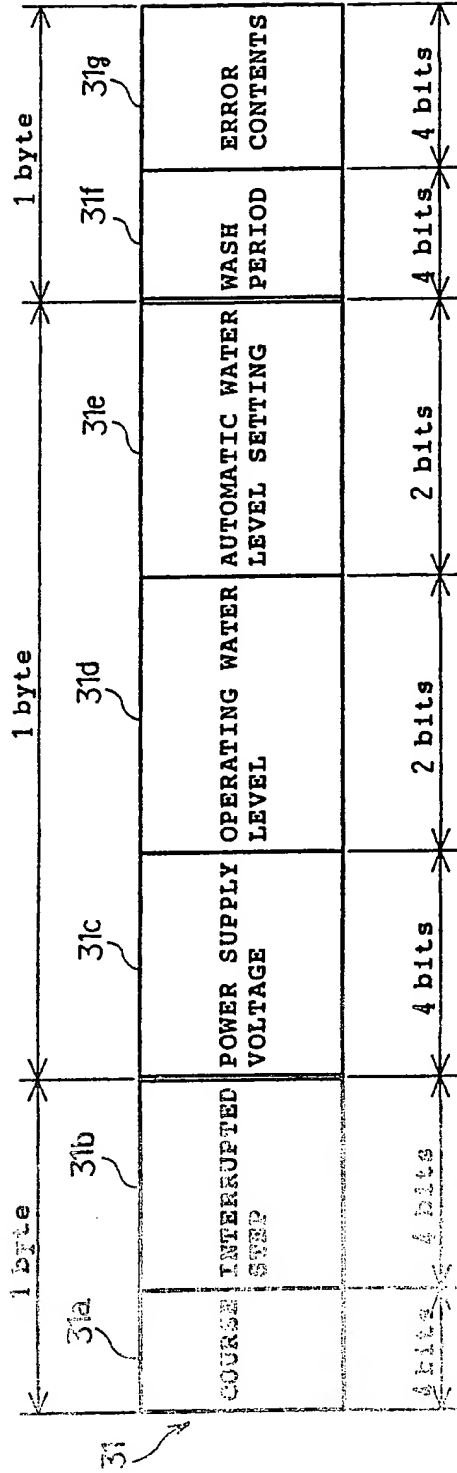


FIG.10

WASHING MACHINE WITH MEANS FOR STORING AND
DISPLAYING DATA OF CONTENTS OF WASHING OPERATION

This invention relates to a washing machine wherein the cause for a failure or trouble can be readily found out so that the machine can be readily repaired in occurrence of the failure or trouble.

Users generally asks an electrical products shop or maker to repair a washing machine when something is wrong with it. In such a case, a serviceman proceeds to the user's home and obtains some information about the operating condition of the washing machine from the user, inspecting and repairing the washing machine. However, it takes much time for the serviceman to understand the cause for the failure when he or she cannot find out the cause only on the basis of the information from the user. Furthermore, the washing machine is sometimes released from the fault condition when the washing machine is operated in an operation mode different from that at the time of occurrence of the failure. In this case, the washing machine is first operated normally but thereafter, it gets out of order again.

Therefore, an object of the present invention is to provide a washing machine wherein the cause for the failure or trouble can be found out upon occurrence of the failure or trouble so that the machine can be promptly repaired or adjusted.

The present invention provides a washing machine

comprising operation control means for controlling a washing operation, a non-volatile memory into which data can be written and from which the data can be read, the non-volatile memory retaining the written data when the power is switched off, memory control means for storing data of contents of a plurality of washing operations executed in the past into the non-volatile memory, readout means for reading out the data stored in the non-volatile memory in response to a predetermined external input, and displaying means for displaying the data read out by the readout means.

According to the above-described arrangement, the contents of the washing operations executed at a plurality of times in the past are stored in the non-volatile memory. More specifically, a record of operations of the washing machine is stored in the non-volatile memory. The record serves for the serviceman or user to find out the cause for the bad condition or failure of the washing machine. When it is necessary to find out the cause for the bad condition or failure, the readout means is operated to read out the data stored in the non-volatile memory, so that the read out data is displayed on the display means. Since the record of operations of the washing machine is obtained from the read out data, the cause for the bad condition or failure can be readily found out.

The contents of washing operations whose data are stored in the non-volatile memory may include either one or more of a washing course, a step at which the operation was interrupted, a level of power supply voltage, an operating

water level, an automatically set water level, a wash period, and error contents. Furthermore, the memory control means may store the data of washing operations when the washing operation is completed, when a power supply switch
5 is turned off, when error occurs, and when the washing operation is interrupted.

The above-described washing machine may further comprises an operation panel, a plurality of operation switches provided in the operation panel for setting washing
10 condition, a washing period and the like, and a display provided in the operation panel for displaying the set washing condition, the washing period and the like. The displaying means may comprise the display. The predetermined external input to the readout means may be
15 obtained by operating the operation switches in a specified mode. Since the means for obtaining the external input and displaying means need not be separately provided, the manufacturing cost of the washing machine can be reduced.

The memory control means may comprise stored data
20 originating means converting the contents of the washing operation to data codes for originating the stored data having a predetermined length and writing means for writing data of a plurality of stored data each having the predetermined length into the non-volatile memory so that
25 the data is stored in the non-volatile memory. In this arrangement, the writing means may have a pointer area for storing address data in the first of a memory area for storing said plurality of data, a plurality of memory areas

provided after the pointer area for storing said plurality of data. Said plurality of data may be stored sequentially in the first to last memory areas respectively. The address of the memory area in which the latest data is stored may be stored in the pointer area. Furthermore, the data is again stored in the first memory area of the non-volatile memory after the data has been stored in the last of said plurality of memory areas. Consequently, the memory areas of the non-volatile memory can be used in a repeated manner and the data of contents of a plurality of washing operations including the latest data can be usually stored in the non-volatile memory.

The display may display four digits and the washing machine may further comprise display control means for controlling the display so that the address of the data read out by the readout means is displayed by use of the higher two digits numeral of the display and the data is displayed by use of the lower two digits of the display when the data is read out by the readout means. The display control means may renew the address and the data displayed on the display every time the operation switch is operated in the condition that the address and the data are being displayed on the display. In this arrangement, the display control means may control the display so that the first address in the memory area of the non-volatile memory is displayed by use of the higher two digits and the data stored in the first address, which data is the address of the area in which the latest data is stored, is displayed by use of the lower two digits

when the readout means reads out the data stored in the non-volatile memory. The address of the memory area wherein the latest data is stored is first displayed on the display. When the address displayed by use of the higher two digits
5 of the display is renewed, the latest data can be displayed by use of the lower two digits. Consequently, the latest data can be promptly recognized.

The invention will be described, merely by way of example, with reference to the accompanying drawings, in
10 which:

FIG. 1 is a block diagram showing an electrical arrangement of one embodiment of a washing machine in accordance with the present invention;

FIG. 2 is a front view of an operation panel of the
15 washing machine;

FIG. 3 is a graph showing steps of operation courses and data codes of interrupted or completed steps;

FIG. 4 is a view diagrammatically showing memory areas of a non-volatile memory employed in the washing machine;

20 FIG. 5 is a graph showing data codes of contents of washing operation to be stored in the non-volatile memory;

FIG. 6 is a flowchart explaining the control manner of a control circuit employed in the washing machine;

FIG. 7 is a flowchart explaining the data readout
25 operation;

FIGS. 8A to 8D show the contents displayed on the display in a readout control;

FIG. 9 is a graph showing the relation between the

displayed contents and the data contents; and

FIG. 10 is a graph showing concrete contents of the stored data.

One embodiment of the present invention will be
5 described with reference to the accompanying drawings. In
the embodiment, the invention is applied to a full automatic
washing machine. Referring to FIG. 1, a control circuit 1
is composed of a microcomputer storing therein an operation
program for controlling the whole operation of the washing
10 machine. The control circuit 1 is supplied with signals
from a lid switch 2, a water level sensor 3, switches 14 to
24 which will be described later, and a power supply voltage
detecting circuit 4 respectively. Based on these input
signals, the control circuit 1 controls a washing machine
15 motor 5, a water supply valve 6, a drain valve 7 and an
automatic power-off circuit 8 through a drive circuit 9 in
accordance with the operation program. Furthermore, the
control circuit 1 is capable of writing data into and
reading data out of a non-volatile memory 12 such as an
20 electrically erasable/programmable read only memory
(EEPROM). Consequently, the control circuit 1 serves as
memory control means, data originating means, writing means,
readout means, display control means, as will be described
in detail later.

25 The construction of the washing machine will be briefly
described. The full automatic washing machine comprises an
outer casing and a water-receiving tub mounted rockably on a
suspension mechanism in the outer casing. A rotatable tub

serving as a wash tub and a dehydration tub is rotatably mounted in the water-receiving tub. An agitator is rotatably mounted on the bottom of the rotatable tub. The above-mentioned washing machine motor 5 and a drive mechanism are provided on the outer bottom of the rotatable tub. The drive mechanism includes a belt transmission mechanism, a clutch mechanism, reduction gears, and a braking device. Rotational force of the motor 5 is transmitted by the drive mechanism to the agitator in each of wash and rinse operations. The rotational force of the motor 5 is transmitted both to the rotatable tub and to the agitator in a dehydrating operation so that they are rotated at a high speed.

A top cover is mounted on the top of the outer casing. An operation panel 13 is provided in the front of the top cover, as shown in FIG. 2. As shown, the operation panel 13 includes a start switch serving both to start the operation of the washing machine and to interrupt the operation, an operation course selecting switch 15, a water-supply and rinse mode setting switch 16, a wash period setting switch 17, a rinse time setting switch 18, a dehydrating period setting switch 19, a manually water-level setting switch 20, and the switches 21-24 for setting a current time and a reserved period or time. The operation panel 13 further includes a display 11 having four-digit seven-segment numeric display elements 11a to 11d and a colon display element 11e. The display 11 is thus capable of displaying four digits. The display 11 usually displays the current

time, the reserved period or time or a remaining operation period. A plurality of light-emitting diodes are provided on the operation panel 13 for indicating the set operation course, the set water level and the like. These light-emitting diodes are also controlled by the control circuit 1.

The operation of the washing machine will be described. When the user operates the switches 15 to 20 on the operation panel 13, the control circuit 13 sets the washing operation course on the basis of the signals from the operated switches 15-20. Subsequently, when the user operates the start switch 14, the control circuit 1 starts and controls the washing operation in accordance with the set operation course. During the washing operation, the control circuit 1 converts the contents of the washing operation into data codes or memory data 31 as shown in FIG. 10, writing the memory data 31 into the non-volatile memory 12 in a manner as will be described later.

The memory data 31 has a predetermined length, for example, three bytes. As shown in FIG. 10, the data 31 includes a 4-bit course memory area 31a, a 4-bit interrupted step memory area 31b, a 4-bit power supply voltage memory area 31c, a 2-bit operation water level memory area 31d, a 2-bit automatically set water level memory area 31e, a 4-bit wash period memory area 31f, and a 4-bit error contents memory area 31g. Data codes "0" to "15" as shown in FIG. 5 are stored in the memory areas 31a to 31g. Although the data codes "0" to "15" are represented in the form of

decimal numerals, they are stored in the memory areas 31a-31g in the form of binary numerals. Accordingly, a 4-bit area is sufficient for storing sixteen data codes "0" to "15" and a 2-bit area is sufficient for storing four data
5 codes "0" to "3." For example, when "MANUAL WASH" is selected as the operation course, the data code "0" is stored in the first 4-bit area or the operation course memory area 31a. The data code "0" is stored in the subsequent 4-bit area or the interrupted or completed step
10 memory area 31b when "BEFORE START" is selected as the interrupted or completed step. Subsequently, the data codes are stored in memory areas in the same manner as described above.

Referring to FIG. 4, the non-volatile memory 12 has a
15 memory area of 128 bytes in the form of a matrix with rows of 16 bytes and columns of 8 bytes. Each byte of the 128 byte memory area shown as each square area in FIG. 4 is addressed by a 1-byte or 8-bit address data. More specifically, the numerals (hexadecimal) "0" to "F"
20 representative of the rows of the memory area are represented by lower 4 bits of the 8-bit address data. The numerals (hexadecimal) "0" to "7" representative of the columns of the memory area are represented by higher 4 bits of the 8-bit address data.

25 The above-described memory area is used in the following manner. An area of first 1 byte indicated by an 8-bit address data "00" is a pointer area. The memory data
31 of the contents of a latest washing operation is stored

in one memory area, and address data indicative of a leading address of the memory area is stored in the pointer area. Following the pointer area, a plurality of memory areas are provided for storing a plurality of memory data 31 of the contents of the washing operation respectively. In the embodiment, twenty-one such memory areas are provided as shown in FIG. 4. The memory areas are shown by "No. 1," "No. 2," "No. 3," ... and "No. 21" in FIG. 4. Memory area No. 1 is a 3-byte area beginning with address data "01." Memory area No. 2 is a 3-byte area beginning with address data "04." Memory area No. 21 is a 3-byte area beginning with address data "3D."

The contents of washing operations whose data are stored in the non-volatile memory 12 include a washing course, an interrupted step, a power supply voltage level, an operating water level, an automatically set water level, a washing period, and error contents. The washing course includes courses of "STANDARD," "STUBBORN," "BULK," "SOFT," and "MANUAL." The interrupted step refers to a step where the washing operation is interrupted or completed. The data 31 does not include all of these contents. One or more of these contents may be selected. Furthermore, items other than those mentioned above may be employed. The above-mentioned error contents include abnormal drainage, opening of an access lid during dehydration, unbalanced state of the tub, abnormal water supply, abnormal state of the water level sensor, abnormal state of the motor, abnormal state of the rotational sensor. The abnormal drainage is determined

by detecting the variations in the water level after the drain valve is opened. The opening of the access lid is determined on the basis of a switch signal from the lid switch during the dehydrating operation. The unbalanced
5 state of the tub is sensed by a unbalance sensor (not shown). The abnormal water supply is determined by the variations in the water level after the water supply valve is opened. The abnormal state of the water level sensor is determined by detecting an abnormal level of a water level
10 detection signal generated by the water level sensor. The abnormal state of the motor is determined on the basis of a rotation detection signal generated by a rotational sensor detecting a rotational speed of the motor after energization thereof. The abnormal state of the rotational sensor is
15 determined by detecting an abnormal state of waveform of the rotation detection signal from the rotational sensor, such as distortion of the waveform.

Control manners for storing data in the non-volatile memory 12 and reading the data out of the non-volatile
20 memory will now be described with reference to FIGS. 6 and 7 showing control contents of the control program whose data is stored in the control circuit 1. Referring to FIG. 6, the control starts when a power supply plug (not shown) is connected to a plug socket. First, the control circuit 1
25 determines whether the switches 14-24 have been operated or not, at step S1. When any one of these switches has been operated, the control circuit 1 determines whether the operated switch is the start switch 14 or not, at step S2.

When the operated switch is not the start switch 14, it is determined whether or not the switches have been in a specific mode as will be described later, at step S3. When the switches have not been operated in the specific mode or
5 when any one of switches 15-24 has been operated, the control circuit 1 sets the condition of the washing operation (control contents) selected by the operated switch at step S4, then returning to step S1. Subsequently, steps S1 to S4 are repeated when the other switches 15-24 are
10 operated in accordance with need of the user, so that the conditions of the washing operation desired by the user are set. Thereafter, upon operation of the start switch 14, the washing operation is initiated on the conditions set as described above (step S5). In this regard, the washing
15 operation is automatically executed in accordance with one of the courses, "STANDARD," "STUBBORN," "BULK," "SOFT," and "MANUAL" and the like, as shown in FIG. 3. When the conditions of the washing operation such as the water level, wash period, water stream mode and the like) are manually
20 set, the washing operation is executed in accordance with the manually set conditions.

The control circuit 1 determines about the following three items during execution of the washing operation. That is, the control circuit 1 determines whether the washing
25 operation has been interrupted or not, at step S6, whether error has occurred or not, at step S7, and whether a power supply switch (not shown) has been turned off or not, at step S8. When the washing operation is completed without

interruption thereof, occurrence of error and turn-off of the power supply switch, the control circuit 1 determines in the affirmative at step S9, advancing to step S10 where the washing operation is completed. Furthermore, the control circuit 1 converts the contents of the completed washing operation to data codes, thereby originating the memory data 31. These contents include the course, the interrupted step, the power supply voltage level, the operating water level, the automatically set water level, the wash period and the error contents, as described above. The initial memory data 31 is written into memory area No. 1 of the non-volatile memory 12. Simultaneously, the address data "01" indicative of the first address of memory area No. 1 is written into the pointer area. The subsequent memory data 31 of the contents of the washing operation is written into memory area No. 2 and so on. After the memory data 31 is written into memory area No. 21, the memory area No. 1 in which the oldest data 31 is stored is renewed so that the latest data 31 is stored in the area. Thereafter, the above-described data processing is repeated.

On the other hand, the control circuit 1 answers in the affirmative at step S6 when the operation has been interrupted during execution of the washing operation. The control circuit 1 converts the contents of the washing operation up to the time of interruption to the data codes, thereby originating the memory data 31. The originated memory data 31 is stored in the non-volatile memory 12 at step S12. In this case, the memory data 31 is stored in the

memory area subsequent to the area in which the last data 31 is stored. It's address data is stored in the pointer area. Subsequently, upon restart of the washing operation, the control circuit 1 answers in the affirmative at step S13,
5 returning to step S6.

Upon occurrence of error during the washing operation, the control circuit 1 answers in the affirmative at step S7. The control circuit 1 converts the contents of the washing operation up to the time of occurrence of the error to the
10 data codes, thereby originating the memory data 31. The originated memory data 31 is stored in the non-volatile memory 12 (step S11). Furthermore, when the power supply switch is turned off during the washing operation, the control circuit 1 answers in the affirmative at step S8. In
15 this case, too, the control circuit 1 converts the contents of the washing operation up to the time of turn-off of the power supply switch to the data codes, thereby originating the memory data 31. The originated data 31 is stored in the non-volatile memory 12 (step S11). Thus, the memory data 31
20 of the contents of the washing operations are stored in the respective memory areas Nos. 1 to 21 of the non-volatile memory 12 sequentially every time the washing operation is executed, whereby the record of the washing operation is accumulated. The address data indicative of the first of
25 the memory area in which the latest memory data 31 is written is stored in the pointer area indicated by the address data "00."

When the washing machine is in a bad condition or when

a failure has occurred in the washing machine, a serviceman inspects the cause for the bad condition or the failure at the user's request. When the switches 15-24 of the operation panel 13 are operated in the specific mode, the data of the contents of the previous washing operation is read out to be displayed on the display 11. For example, when the power supply switch (not shown) is turned on with simultaneous turn-on of the switches 17-19, the control circuit 1 answers in the affirmative at step S3, advancing to step S14 where a subroutine for the data readout control is executed. The subroutine is shown in FIG. 7. In this case, the latest memory data 31 is stored in memory area No. 13 of the non-volatile memory 12.

Upon execution of the subroutine shown in FIG. 7, the address data "00" of the pointer area is displayed by the higher two digit display elements 11a and 11b of the display 11 and the data stored in the pointer area, that is, address data "25" indicative of the first of the memory area in which the latest memory data 31 is stored is displayed by lower two digit display elements 11c and 11d of the display 11, as shown in FIG. 8A (step G1). Consequently, it is understood that the memory area in which the latest memory data 31 is stored or the address data (address) of the memory area in which the data 31 was written last is "25." When the wash period setting switch 17 is operated in the condition that the above-mentioned data are on display, the control circuit 1 answers in the affirmative at step G2, advancing to step G3. The address data is incremented

(renewed) one byte so that the address data "01" is displayed by the higher two digit display elements 11a, 11b and the data stored in the displayed address data "01" is displayed by the lower two digit display elements 11c, 11d (step G3). Thereafter, the control circuit 1 returns to step G2 where the control circuit 1 answers in the affirmative every time the wash period setting switch 17 is operated. Then, at step G3, the address data is incremented one byte so that the incremented address data is displayed by the higher two digit display elements 11a, 11b and the data assigned the displayed address data is displayed by the lower two digit display elements 11c, 11d (step G3). Execution of the subroutine as shown in FIG. 7 is stopped when the power supply plug is pulled out of the plug socket.

When the contents of the washing operation whose data is stored in the latest memory data 31 are to be examined, the wash period setting switch 17 is operated at a predetermined number of times so that the first address data "25" of the memory area No. 13 is displayed by the higher two digit display elements 11a, 11b, as shown in FIG. 8B. Then, data "14" is displayed by the lower two digit display elements 11c, 11d, as shown in FIG. 8B. The displayed data "14" is one byte of data beginning with the forefront of the latest memory data 31. As understood from FIG. 9, the data "14" represents that the executed course is the "STANDARD" course and that the interrupted step is "DEHYDRATION 1."

When the wash period setting switch 17 is further operated in the condition as shown in FIG. 8B, the second 1-

byte address data "26" of the memory area No. 13 is displayed by the higher two digit display elements 11a, 11b, as shown in FIG. 8C. Simultaneously, the second 1-byte data "85" of the latest memory data 31 is displayed by the lower two digit display elements 11c, 11d. As understood from FIG. 9, the data "85" represents that the power supply voltage ranged between 100 and 101.5 V, the operating water level was "MIDDLE," and that the automatically set water level was "MIDDLE" in the executed washing operation.

When the switch 17 is further operated in the condition as shown in FIG. 8C, the third 1-byte address data "27" of the memory area No. 13 is displayed by the higher two digit display elements 11a, 11b, as shown in FIG. 8D. Simultaneously, the third 1-byte data "A1" of the latest memory data 31 is displayed by the lower two digit display elements 11c, 11d. As understood from FIG. 9, the data "A1" represents that the wash period was 10 minutes and that the error contents were "ABNORMAL DRAINAGE" in the executed washing operation. The latest memory data 31 is read out and displayed in the manner as described above. Based on the displayed data, the serviceman or the user can find that the drainage became abnormal in the step of "DRAINAGE 1" and that the washing operation was interrupted.

According to the above-described embodiment, the data of contents of the washing operations executed at a plurality of times in the past are stored in the non-volatile memory 12. The switches of the operation panel 13 are operated in the specific mode so that the external input

is obtained for reading out the data stored in the non-volatile memory 12. The data are displayed by the display 11. Accordingly, the data of contents of the washing operation can be read from the non-volatile memory 12 to be
5 displayed when the washing machine is out of order or when a failure has occurred in the washing machine. Since the serviceman or user can obtain the record of operation contents of the washing machine from the displayed data, he or she can easily find the cause for the trouble or failure
10 of the washing machine. Empirically, the washing machine is sometimes released temporarily from the trouble or failure at the time of repairs even when the trouble or failure has occurred in the washing machine. In this case, it is difficult to find out the cause for the trouble or failure.
15 Thereafter, the same trouble or failure occurs in the washing machine when it is operated. However, in the above-described embodiment, the cause for the trouble or failure can be easily found out even in such a case since the record of operation contents of the washing machine can be read out
20 to be displayed.

In the foregoing embodiment, the power supply switch (not shown) is turned on with simultaneous turn-on of the switches 17-19, so that the readout and display control for the memory data 31 stored in the non-volatile memory 12 is
25 executed. Accordingly, the readout and display control can be prevented from being inadvertently executed by the user in the usual washing operation. Furthermore, the display 11 is utilized to display the data read out of the non-volatile

memory 12. The display 11 is primarily provided for displaying the current time, reserved time or period and the leftover period. Consequently, the increase in the component parts can be prevented and accordingly, the manufacturing cost of the washing machine can be reduced.

The foregoing description and drawings are merely illustrative of the principles of the present invention and are not to be construed in a limiting sense. Various changes and modifications will become apparent to those of ordinary skill in the art. All such changes and modifications are seen to fall within the true spirit and scope of the invention as defined by the appended claims.

WE CLAIM:

1. A washing machine comprising:

- a) operation control means for controlling a washing operation;
- 5 b) a non-volatile memory into which data can be written and from which the data can be read, the non-volatile memory retaining the written data when the power is switched off;
- c) memory control means for storing data of contents of a plurality of washing operations executed in the past into
- 10 the non-volatile memory;
- d) readout means for reading out the data stored in the non-volatile memory in response to a predetermined external input; and
- e) displaying means for displaying the data read out by
- 15 the readout means.

2. A washing machine according to claim 1, wherein the contents of washing operations whose data is stored in the non-volatile memory include either one or more of a washing course, a step at which the operation was interrupted, a

20 level of power supply voltage, an operating water level, an automatically set water level, a wash period, and error contents.

3. A washing machine according to claim 1, wherein the memory control means stores the data of washing operations

25 when the washing operation is completed, when a power supply

switch is turned off, when error occurs, and when the washing operation is interrupted.

4. A washing machine according to claim 1, further comprising an operation panel, a plurality of operation
5 switches provided in the operation panel for setting washing conditions, a washing period and the like, and a display provided in the operation panel for displaying the set washing condition, the washing period and the like, and wherein the displaying means comprises the display, and
10 wherein the predetermined external input to the readout means is obtained by operating the operation switches in a specified mode.

5. A washing machine according to claim 1, 2, 3 or 4, wherein the memory control means comprises stored data
15 originating means converting the contents of the washing operation to data codes for originating the stored data having a predetermined length and writing means for writing the data of a plurality of stored data each having the predetermined length into the non-volatile memory so that
20 the data are stored in the non-volatile memory.

6. A washing machine according to claim 5, wherein the writing means has a pointer area for storing address data in the first of a storage area for storing said plurality of data, a plurality of memory areas provided after the pointer
25 area for storing said plurality of data, wherein said

plurality of data are stored sequentially in the first to last memory areas respectively, and wherein the address of the memory area in which the latest data is stored is stored in the pointer area.

5 7. A washing machine according to claim 6, wherein the data is again stored in the first memory area of the non-volatile memory after the data has been stored in the last of said plurality of memory areas.

10 8. A washing machine according to claim 7, wherein the display is capable of displaying four digits and which further comprises display control means for controlling the display so that the address of the data read out by the readout means is displayed by use of the higher two digits of the display and the data is displayed by use of the lower
15 two digits of the display when the data is read out by the readout means.

20 9. A washing machine according to claim 8, wherein the display control means renews the address and the data displayed on the display every time the operation switch is operated in the condition that the address and the data are being displayed on the display.

10. A washing machine according to claim 9, wherein the display control means controls the display so that the first address in the memory area of the non-volatile memory is

displayed by use of the higher two digits and the data stored in the first address, which data is the address of the area in which the latest data is stored, is displayed by use of the lower two digits when the readout means reads out
5 the data stored in the non-volatile memory.

11. A washing machine substantially as herein described with reference to the accompanying drawings.